



E. SCOPE OF WORK

This scope of work is presented in conformance with the Tasks and Deliverables identified in the City's Water Systems Distribution Master Plan RFP

TASK 1: MASTER PLAN

The scope of this Task will include review of the City's 1986 Water Master Plan and the 2013 Phase 1 Water Facilities Study. The 1986 Water Master Plan was prepared when the Georgia Pacific Mill was still in operation and the Fishing Industry was a major Fort Bragg area employer. These conditions have significantly changed since that time. Updates to the Water Master Plan will be prepared to reflect current and projected land use conditions. Typically, Master Plans are prepared for a 20 year horizon. Unless otherwise directed by City Staff, the Water Systems Distribution Master Plan Update will be prepared to serve the Fort Bragg service area for the period 2023 - 2043.

The purpose of the Phase 1 Water Facilities Study was "to identify and prioritize improvements to the City of Fort Bragg raw water supply and treated water distribution systems to ensure that adequate water facilities are available to meet current maximum day and fire flow demands and the water demands of future, General Plan, level, growth."

The Phase 1 Water Facility Study specifically did not include the water system demands and needs associated with potential development in the Mill Site Specific Plan Area. The 2023 demands considered in the Phase 1 Study reflected the City's General Plan growth projections of 0.5% per year increase in demands for the City's inland areas and a 2% per year increase in demands within coastal areas. With these growth and assumptions, maximum day water system demands were projected to increase from about 1.2 Million Gallons per Day (MGD) in 2012 to about 1.49 MGD in 2032. These future projected demands could still be met by the City's existing Water Treatment Plant Capacity of 2.0 MGD. These demands could also still be served by the City's water rights to the Noyo River (3 cfs, or 1349 gpm = 1.94 MGD) together with diversion rights to the Newman Gulch (up to 300 ac-ft/yr) and to

Waterfall Gulch (up to 0.688 cfs or \pm 300 gpm). While Water Treatment and Water Storage Facilities can be expanded to meet future water demands in excess of 2.0 MGD the Water Master Plan will need to reflect practical limits of the City's raw water supply sources, now and extending forward, through the Master Plan horizon.

In addition to the anticipated land uses and water demands to be considered for the Mill Site, the updated Water Master Plan will be prepared to reflect the Fort Bragg North Side development included in the 2019 North Side Study, land uses to be served with annexations projected for the south and east side of the City and changes to the land uses now occupied by the Fishing Industry. Since completion of the Phase 1 Water Facilities Study, maximum day and peak hour water demands within the Fort Bragg service area have remained nearly constant. This "no growth" trend is not expected to continue over the next 20 years.

Water Distribution System Improvements included in the Phase 1 Water Facilities Study

Findings of the Phase 1 Water Facilities Study will be reevaluated in the Updated Master Plan. Recommended improvements included the identification of low fire flow and low pressure conditions north and east of the East Fort Bragg Pressure Zone (EFBPZ). To correct these low fire flow and low pressure conditions it was recommended in the Phase 1 Study to expand the EFBPZ.

Recommended EFBPZ expansion improvements included:

- 340 LF of 8" main, Oak Street, Park to Harold
- 370 LF of 8" main, Dana Street, Dick Williams to Cedar Street
- 660 LF of 8" main, Cedar Street, Dan Street to Sanderson Way
- Miscellaneous valve and pipeline connection modifications

Pipeline improvements recommended in the Phase 1 Study to improve low



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pressure and low fire flow conditions within the EFBPZ included:

- Replace the Dana Street main south of Foot Path Way with a 10 inch diameter main.
- Replace the existing north and east legs of the High School Fire Loop with a 10 inch diameter main.
- Construct a new 10 inch diameter main across the Fort Bragg High School Baseball Field (APN 020-530-02) and along the west and north sides of APN 020-530-10 and connect this new pipeline with the existing 8 inch main located in Hocker Lane.
- Provide connection of the Dana Street main, north, across Oak Street.

Several of the above listed improvements are included in the improvement plans prepared by KASL in the Willow Street Pump Station and Water Network Improvement Plans.

Other water distribution system improvements outside of the EFBPZ recommended in the Phase 1 Study are:

- Replace existing 6" main with 8" main, alley between Whipple Street and Correy Street, Maple to Oak.
- Replace existing 6" main with 8" main Morrow Street, north of Cedar Street.
- Replace existing 6" main with 8" main, Nancy Way.

In the Phase 1 Study low pressures were identified in areas near the existing Fort Bragg Water Treatment Plant. In addition to expansion of the EFBPZ to serve portions of this area, consideration shall be given in the Updated Water Master Plan to the creation of a new Water Treatment Plant Zone (WTPZ). With Booster Pump Station improvements, the new WTPZ could also serve the General Plan Annexation Areas located on the east side of Fort Bragg.

Pipeline Replacement Improvements

The Phase 1 Water Facilities Study identified steel pipelines in use on Cedar Street and on Sanderson Way. In addition, there was identified some 145,550 LF of Asbestos Cement Pipe (ACP) water mains placed in the 1960's and 1970's that were still in use. It was recommended in the Phase 1 Study that the City implement a pipeline replacement program to replace the aging steel and ACP pipes with PVC C900/C905 or Class 50 Ductile Iron Pipe. The Updated Water Master Plan shall include "revisiting" these recommendations and identify pipeline replacements that have occurred since the 2013 recommendation.

North Side Water System Improvements

North side water system improvements identified in the Phase 1 Study are included in the 2019 North Side Study. These are scheduled for design and construction beginning in 2023.

TASK 1 DELIVERABLES

Technical Reports

The Task 1 deliverables will include a technical report which itemizes and identifies City of Fort Bragg Water System Distribution improvements which have been implemented since the completion of the 2013 Phase 1 Water Facilities Study.

The technical report will also update the recommended limits of an expanded EFBPZ and the suggested limits and improvements to be included in a new WTPZ to serve existing customers located near the Fort Bragg Water Treatment Plant and the new customers located within suggested General Plan Annexation Areas on the east side of the City (LU Annexation Areas 1, 2, 3 and 4) identified in the Land Use Element of the General Plan.

Draft Master Plan Report

A draft Master Plan Report will be prepared updating the current Water Master Plan and the Phase 1 Water Facilities Study. The draft Water Master Plan will be the product of several working meetings with staff to identify and quantify the land uses





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and the demands within the Mill Site Specific Plan, future land uses along Noyo Harbor and the land uses projected within the southerly and easterly annexation areas identified in the City's General Plan.

Final Master Plan

The Final Master Plan prepared will respond to comments, suggestions and revisions from Staff to the Draft Master Plan Submittals. The Final Master Plan will also reflect comments received from the City Council at up to three presentations of the Draft Master Plan at City Council Meetings.

TASK 2: MAPPING AND MODELING

Existing Hydraulic Network Model

There are approximately 2000 pipelines and 1000 connecting nodes in the Fort Bragg Hydraulic Network Model. The current model reflects the improvements proposed to serve the North Side Study Area and includes improvements to serve the Plateau Housing Project. KASL has been serving the City as the "custodians" of the hydraulic network model. The model belongs to the City by virtue of the fee that the City paid KASL in 2013 to develop and calibrate this tool. To operate the Fort Bragg Model, KASL pays Bentley (the developers of the WaterCAD programs) an annual fee for a WaterCAD license. If KASL is selected by the City to prepare the Water Systems Distribution Master Plan, we are available to help City Staff operate the Hydraulic Network Model themselves. The City will, however, need to obtain their own WaterCAD license. This will allow the City to run the Fort Bragg Model in AutoCAD or ArcMap. KASL would be available to support City Staff with operation of the model, testing new water demands and water system expansion conditions.

There are other hydraulic network model programs available. We have found that since the WaterCAD Model operates in AutoCAD it is an appropriate network software to use with the City's AutoCAD based mapping. The WaterCAD program is robust, can be expanded with network additions and demands and can respond to a wide range of "what if" scenarios.

The existing model can be used to effectively test system criticality, resiliency and response to hazards and risks.

TASK 2 DELIVERABLES

Hydraulic Distribution System Model

A Technical Memo will be prepared which outlines in detail the benefits of the existing WaterCAD based Hydraulic Network Model. We believe that the existing Hydraulic Network Model has served the City well and produces accurate findings regarding available pressures and flows under various demand conditions (maximum day, maximum day plus fire flow, peak hour). It has been used effectively to recommend system improvements and to correct deficiencies in system flow and pressure.

Review of Existing Distribution System

The existing hydraulic network model was developed and calibrated from field surveys to identify the location and elevation of existing water main appurtenances. Hydrant flow and pressure tests were conducted at 30 separate hydrants with pressure testing conducted simultaneously at the flowing hydrant and at the upstream and downstream hydrants (total of 90 real time pressure tests).

Field measured hydrant flows were then entered into the network model. Residual hydrant pressures produced by the network model were compared to field measured residual pressures. Very close comparison (± 1 to 5 psi) was found between field measured pressures and model pressures with the exception of two areas; one in a section of the network pipeline located near the Pudding Creek Crossing and one in a pipeline located along the south side of Fort Bragg High School. A friction factor was added to these two pipeline section to improve system calibration. Additional field surveys and measurements shall be conducted as part of our scope of work to identify the exact cause of the additional friction losses occurring in these two pipelines.

The existing model was prepared using the pipe diameter and pipe friction factor assigned to the pipe material (steel, ACP, PVC, DIP)



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identified in the City's system maps. We will review the existing distribution system mapping with Fort Bragg operators and Public Works personnel and identify any pipeline improvements that have been constructed since 2013. The hydraulic network model will be updated to reflect these improvements.

Where there are existing pipeline improvements which the City Public Works or Operations Staff suggest have been incorrectly or inaccurately included on the City's improvement plans and in the Hydraulic Network Model we will conduct ground penetrating radar field tests or potholing, as necessary, to confirm or to adjust pipeline locations, material and size.

Field Investigations and Assessment of Existing Conditions

Field surveys will be conducted at locations throughout the City of Fort Bragg to verify the location and elevation of existing visible water network facilities (valves, hydrants, booster pump station, tanks). Updated field survey data will be compared to the elevations and location of water system appurtenances included in the hydraulic network model. Corrections to the model will be made, if necessary, to reflect the updated field survey data. Engineering staff will accompany our surveyors to record the condition and attributes (model, type of hydrants, valves, valve boxes, booster pump station equipment) of the water system appurtenances.

Where potholing is conducted field surveys will be completed to verify pipeline depth (invert) and pipe size and material. Conditions assessment of exposed pipelines will be completed at that time. We will review City maintenance records and identify field information collected by City crews regarding the condition, size and material of pipeline where repairs have been completed.

Survey Data

All updated survey data conducted for this Master Plan will be uploaded and submitted to the City.

Distribution Database

Distribution System attributes (manufacturer, make, model number, age) and conditions recorded by our Project Engineers and evaluated from City Maintenance Records will be uploaded to a GIS database by ECORP Consultants. ECORP will coordinate with the City the selected software to be used for the City's GIS database.

Updated Hydrant Network Model

Hydraulic Network Updates reflecting field surveys, elevations and locations, ground penetrating radar results, potholing, City maintenance records and condition assessments completed for this Task will be included in the Updated Hydraulic Network Model delivered to the City.

TASK 3: ANALYZING ENVIRONMENTAL VARIABLES

Evaluation of Existing Water Distribution Systems to Meet Future Growth

This analysis will reflect updates to the Master Plan discussed in Task 1. The ability of the existing water distribution system to deliver adequate flow and pressure to the Mill Site Specific Plan uses, the proposed North Fort Bragg industrial uses, future development in the Harbor Area and service to future annexation areas will be determined based on the anticipated land uses and water system demands of these Master Plan areas identified with City Staff in Task 1. Projected land uses and water demands will also reflect the City's Municipal Services Review Report and the growth factors applied to these Master Plan land uses.

Updates to the hydraulic network model will reflect the deliverables developed in Task 2 of the Water Systems Distribution Master Plan. Using the updated hydraulic network model the existing water system will be evaluated with respect to maximum day demands, maximum day plus fire flow demands and peak hour demands applied to the existing uses and to the new and expanded City of Fort Bragg land uses described above.



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Water system improvements needed to meet the Master Plan demand conditions will be itemized as part of this Task.

Water demands with the new and expanded land uses will be compared to the City's current permitted water rights.

Water Shortage Contingency Planning

The City's water supplies are provided by surface water pumped from the Noyo River and spring flow delivered by gravity pipeline from Waterfall Gulch and Newman Gulch. While the City's annual water rights of 1800 acre feet have been adequate to meet annual water demands, most of the water is supplied from the Noyo River which is subject to the curtailment of diversions.

From June 1 to October 1, the Noyo River must be maintained at a minimum of 3 cfs to permit the City's diversions. Between October 1 and June, Noyo River diversions are curtailed if flows in the Noyo River are less than 10 cfs. Under low flow conditions, raw water diversions are only permitted if tidal conditions result in river elevations 2 feet or higher. Because of this curtailment water shortages do occur and water shortage contingency planning is required.

Flows in the Noyo River are completely dependent on local rainfall and runoff within the Coastal range watershed. The average annual rainfall at Fort Bragg is approximately 40.3 inches per year. When the annual Fort Bragg rainfall drops to less than 80% of the annual average (to less than approximately 32 inches per year) low flows typically occur in the Noyo River and the City's raw water diversions from this raw water supply source may be limited. In the 2013 Phase 1 Water Facilities Study curtailments to the Noyo River diversion were reported in 2008 and in 2009. Prior to that period curtailments occurred in 1976, 1977, 1980 and 1985.

The City does have in place water shortage contingency plans. Stage 1, Stage 2 and Stage 3 alerts are applied to reduce water demands during dry years, low Noyo River flows and water curtailments. We will review the City's experience with their current water storage

contingency plans and develop with City Staff possible improvements to these contingency plans. We will also identify water shortage contingency plans and enforcement contingencies that other cities and communities (especially Coastal cities similar to Fort Bragg) have developed as alternative water shortage contingency planning and enforcement tools.

Water Sources and the Impacts of Climate Change

Dale Bugenig, our hydrogeological expert has been included in our Proposal Team to address the impact of climate change on the City's water sources.

Spring Source Evaluation

As part of his scope, Dale will determine the relationship between annual precipitation and discharge records for Waterfall Gulch and Newman Gulch. Long-term precipitation records for the Mendocino Coast will be compared to long-term records of spring discharge. Springs supplied from local flow systems often show seasonal variations. Springs sourced from regional flow systems often show less variations in discharge and also exhibit a lag behind precipitation events. If a correlation between precipitation and spring flow exists, then predictions of future spring supply can be made based on models of future precipitation resulting from climate change.

Additional work may include analysis of spring water for stable isotopes of hydrogen and oxygen. These can provide a "finger print" indicative of the area of recharge for the springs and whether they are related to local or regional flow systems. Aerial imagery and geologic mapping will be also be incorporated into this analysis.

Groundwater Source

The Franciscan mélange that comprises the Coast Range near Fort Bragg does not typically provide large quantities of groundwater to wells. Neither do geologic formations that make up the coastal terraces. The investigation of local groundwater resources will start with a review of the California Department of Water



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Resources on-line well database. This will help identify areas that warrant further investigation. Perhaps the best potential to develop a groundwater source exists from the alluvial deposits associated with the Noyo River and Pudding Creek. There are potential issues with this stratagem. These deposits do not appear to extend far from the streams. The fact that the alluvial deposits may not be aerially extensive raises the specter of interaction between groundwater pumped from wells and surface water flows. This was a limiting factor to groundwater development near Gualala. For the Noyo River, where surface water supplies are impacted when river flow drops below ten cubic feet per second, groundwater extractions might also decline.

Cities, counties and water districts that have historically depended on surface water as their source of supply are drilling and developing groundwater wells to provide an alternative water supply source during drought periods. Conjunctive use programs are also being developed wherein groundwater wells are designed as ASR (Aquifer Supply and Recovery) wells that will use excess surface water during wet years to replenish groundwater resources. This strategy will be evaluated for the City of Fort Bragg depending on the results of Dale's investigations regarding the viability of groundwater resources available in the Fort Bragg area.

Flooding and Sea Level Rise

Review of the Safety Element of the City General Plan suggests that areas of the City along Noyo Creek, Pudding Creek and Hare Creek are subject to flooding and sea level rise. With the exception of limited water distribution system improvements within the Noyo Harbor area exiting Fort Bragg water system pipelines are typically located outside of areas subject to these environmental conditions. Improvements to the water distribution systems to serve Harbor area development should be Master Planned to avoid areas subject to flooding. Similarly, water distribution system improvements now proposed north of Pudding Creek to serve North Fort Bragg industrial land uses should be designed to avoid areas subject to flooding hazards.

The scope of the Water Mater Plan Improvements will include improvements to existing Noyo Harbor water distribution pipelines, valves and appurtenances to mitigate against damage from flooding. These may include provisions such as replacing existing pipelines in this area with fused PVC or HDPE pipe material with limited or no joints.

Geotechnical hazards.

As part of the KASL Team, ENGENEO will perform system wide review of geotechnical and geologic hazards to characterize, determine and identify areas within the system where increased risk of geologic or geotechnical hazards may pose risks to the water system. ENGENEO's scope of services will include:

- Field reconnaissance – An ENGENEO engineering geologist will perform a field reconnaissance of portions of the water system that are identified as potentially high risk during the document review. ENGENEO will observe surface conditions and geomorphologic features related to geotechnical and geologic hazards such as slope instability including landslides and erosion. ENGENEO will also photograph key areas of the water system. ENGENEO anticipates 2 days of reconnaissance will be necessary and close coordination with City staff will be required.
- Data compilation – ENGENEO will compile pertinent information from the document review and field reconnaissance in a GIS portal. Publically available LiDAR will be included. This data will be made accessible for viewing by the project team and by the City in a GIS portal; GIS files will be made available for uploading to the City's GIS database by ECORP Consulting.
- Analysis and report preparation – ENGENEO will analyze the data collected and prepare a geotechnical and geologic risk assessment report for the water system. The intent of the report is to identify and avoid areas of geotechnical and geologic risk for Master Planning. The report will discuss the potential risks associated with a large seismic event including ground shaking, ground rupture, seismically



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induced landslides, liquefaction, subsidence, and tsunami. The report will also discuss non-seismic related hazards such as landslides and debris flows (including potential post wildfire impacts), subsidence, and flooding. The report will include figures with geotechnical and geologic risk delineation, pertinent geologic information, field observations, and photos as well as a discussion of conceptual mitigation solutions for high risk portions of the system.

Other Environmental Factors

As part of the scope of their work ENGEIO will conduct select soil sampling to evaluate existing soils for corrosiveness and pH. Typically, these factors are resolved by specifying that replacement pipelines are PVC C900 / C905 material and that buried ductile iron pipe are polyethylene encased in accordance with AWWA 105 Standards and that flanged fittings, mechanical joints or other buried ductile iron pipeline appurtenances be double wrapped with polyethylene.

TASK 3 DELIVERABLES

Technical Report

The Task 3 deliverables will include a Technical Report which will include:

- Future City of Fort Bragg Water Demands
- Evaluation of current water shortage contingency planning and strategies and alternative contingency planning
- Water source strategies to respond to climate change and the impact of drought conditions on surface water supply sources
- Recommendations regarding protection of water distribution system improvements against flood hazards and sea rise and recommendations to avoid areas subject to flooding and sea rise with the Water Systems Distribution Master Plan improvements
- Analysis of geotechnical sensitive areas and measures to mitigate against seismic hazards in high risk areas of the water distribution system.

Our environmental team led by Planning Partners will also contribute to the Task 3 Technical Report. Planning Partners will identify, obtain and review information regarding demography, land use, hazards, resource planning, environmental constraints and ethical practices. Sources of information to be reviewed will include land use, hazard and infrastructure plans prepared by the City, Mendocino County, Mendocino LAFCo, and other State and federal agencies as appropriate. Planning Partners will assist the engineering team with respect to the demographic and planning influences on future water demand.

CEQA Compliance Memo

As part of their scope, Planning Partners will prepare a memorandum setting forth an evaluation of the benefits and risks of preparing a Programmatic EIR (PEIR) on the Water Systems Distribution Master Plan and its components, relative to the City's current strategy of preparing multiple CEQA documents as individual projects arise. In addition to discussing the utility of a PEIR, the memo will evaluate different CEQA strategies, various document types and timing, required analyses of direct and indirect environmental effects and the inclusion of NEPA required information in CEQA documents. Planning Partners would prepare an analysis of various strategies to comply with CEQA and provide a range of cost for each identified strategy.

TASK 4: CAPITAL PROJECT PLANNING

This task will include a summary and prioritization of the water system distribution improvements developed in Tasks 1, 2 and 3. Recommended improvements will address the City's Master Plan goals and objectives of system resiliency, sustainability and long term operation. Recommended and priority improvements will reflect input from workshop meetings with City Staff and results of presentations to the City Council. Recommended improvements will be proposed that adequately meet current and projected maximum day and fire flow demands and peak hour demands identified in this Study.



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Cost estimates will reflect the current, or projected, ENRCC cost index so that estimated costs can be adjusted to plan for future implementation.

ECORP Consulting, as part of GIS database services, will evaluate the City's current asset management practices and recommend future asset management procedures for evaluating and replacing aging infrastructure. The Task 4 services will include water distribution system funding opportunities. These will include the State Water Resource Control Board Drinking Water State Revolving Fund, USDA Rural Utilities Services (RUS) Funds and CDBG funding. The City has been successful in obtaining grant funding on other public works projects. We will work with City Staff to identify other fund sources that the City has successfully used to fund public works utilities.

TASK 4 DELIVERABLES

Project Practicability Report

Replacement pipeline materials recommended shall be consistent with current City operations to standardize distribution system operations and maintenance. Operations and maintenance costs and O & M complexity will increase with the introduction of new materials. We understand that the City currently installs PVC C900 / C905 or DIP for waterline replacements. The outside diameter and the fitting dimensions for these pipe materials are identical. This practice should continue. Similarly, the City should standardize replacement valves and hydrants to provide ease of replacement and repair parts.

Technical Memo of Risk-Based Analysis

This analysis will be developed from the Task 3 analysis of geotechnical hazard sensitive areas, areas subject to flooding and sea rise hazards and other environment facilities identified in Task 3.

New, Innovative and Emerging Water System Technology

Water distribution mains constructed at bridge crossings and at locations such as Water

Storage Tanks and Pump Stations are particularly vulnerable to ground displacement from seismic activity. We will evaluate existing improvements at these locations and recommend flexible connections (ROMAC Double Ball Expansion Joints, for example) which allow for vertical and horizontal deflection without damage to the pipeline or to the connecting structure.

The City is in the process of installing Smart Meters for water service customers. These meters will help identify water leaks and losses and will help the City reduce current water loss rates.

We will evaluate with the City the cost and benefits of distribution system pressure sensing stations and automatic control valve installations that would alert the City operators to rapid losses in pressure due to a pipe break and would isolate low pressure areas from the rest of the City's system until they can be repaired.

Schedule of Improvements

A schedule of recommended improvements will be provided based on prioritization and funding opportunities. Typically, improvements would be scheduled for short term (1 to 5 years) medium term (5 to 10 years) or long term (10 to 20 years) implementation in the Master Plan.

Preliminary Engineering Report

A Preliminary Engineering Report (PER) will be prepared for the recommended water distribution systems improvements. The PER will include system mapping, a listing and identification of priority improvements, cost estimates, preliminary environmental review and project funding. The PER will be prepared specifically to "fast track" grant applications by the City and award of grant funds by the State and Federal Agencies.

ALTERNATIVE TASK

Planning Partners has prepared a sample Scope of Work for an Infrastructure Master Plan Program EIR. This sample scope of work is included in the Appendix of this Proposal.